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JUNIOR HIGH SCHOOL

INDUSTRIAL ARTS

CITY PUBLIC SCHOOLS
SACRAMENTO, CALIFORNIA
June, 1931

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COURSE OF STUDY MONOGRAPH

NUMBER THIRTY - THREE

INDUSTRIAL ARTS

CITY PUBLIC SCHOOLS, SACRAMENTO, CALIFORNIA

JUNE, 1931

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FOREWORD

We have assumed from the beginning of our efforts in the field of curriculum construction that the results of our labors would accrue to the best interests of the children and youth of our community, if we were able at all times to realize on the composite judgment of large numbers of people.

This is the generally accepted cooperative plan. It not only affords a better evaluation of materials to be used, but it proves of real value to the individual teacher by assisting him in putting into the classroom in an effective way the suggested materials.

We have had some assistance from specialists which has proved of great worth. The chief consultant along with the administrative group, has made final reviews of all courses.

We recognize the fact that curriculum construction must be a continuous process. With this fact in mind, we have printed all courses of study in loose-leaf form so that needed changes may be made as they develop.

The arduous and complex work of committees in the different fields is to be commended.

CHAS. C. HUGHES,
Superintendent of Schools

GENERAL INTRODUCTION

Articulation among the various units of the school system has been given much careful thought in this country during the past few years.

In keeping with this effort the vocational training units within our own system have worked together during the present year to develop curricula which are properly inter-related and which give a degree of unity to the whole program.

It has been the aim to provide a reasonably unified program, common in broad aims and objectives, simplified by similarity of method and procedure as far as may be, and at the same time to retain the specific objectives of each of the several courses clear, and the methods for their accomplishment effective.

That this material is tentative and incomplete, and that in its present form it does not completely fulfill the objectives of the department as here stated will be evident to any competent reader. It is submitted at this time as material in process of development only.

While the junior college comes within the purview of this program it is not actually represented in the material here presented. The Senior high school, the junior high schools, and the continuation high school make up the present list.

The adoption of the principle of individualized instruction throughout the vocational program with the use of "self-instructing lesson sheets" to effect this instruction is one evident result of the curriculum development in this field. The greater unity of thinking throughout this field and the emphasis upon clearly defined purposes in each of the segments of the system are results of greater significance although not directly evidenced in such a publication of courses.

Table of Contents

General Objectives Industrial Arts 8

The Course—A Statement 9

Appreciations to be Developed 11

A General Shop Unit 11

Junior High School Shop Standards:

- General Condition 12
- The Tool Room 13
- Care of Benches and Equipment 13
- Handling Supplies 14
- Selection of Projects 15
- Fishing Methods 15

Mechanical Drawing—Beginner's Course 17-24

Woodwork—Beginner's Course 26-39

Bench Metal Work—Beginner's Course 41-50

Sheet Metal Work—Beginner's Course 52-58

GENERAL OBJECTIVES

"As a subject for educative purposes, industrial arts is a study of the changes made by man in the forms of materials to increase their values, and of the problems of life related to these changes."—Bonser and Mossman.

The handling of raw materials, the study of tool and machine processes, the participation in construction and the acquiring of much related information are all experiences that lead to occupational intelligence, an appreciation of industrial relations, and intelligent consumption of industrial products. While we state here our general and specific objectives, we justify our place in the curriculum on no greater grounds than the possession of subject matter in itself worth while.

In stating objectives effort has been made to keep in harmony with the most advanced thought and practice, which places the emphasis upon the exploratory and developmental aims of general education rather than the more restricted aims of prevocational and vocational education.

The department has seen fit to set forth a single controlling aim and to state specifically the desirable outcomes that should be realized from the teaching of Industrial Arts.

Controlling aim—Developmental experiences through manipulative and informational activities leading to appreciative knowledge of the industrial world.

Desirable outcomes to be gained from the Industrial Arts courses:

1. Broad occupational intelligence resulting from the exploration of the representative industrial activities
2. A more substantial basis for occupational choice resulting from the guidance values of shop courses
3. The finding of one's life work through school shop and industrial contact
4. Command of certain fundamental industrial processes
5. The cultivation of individual bents and aptitudes for avocational happiness
6. The development of a large number of character traits and attitudes necessary for successful industrial relationships
7. Domestic intelligence, a fitness for intelligently buying, utilizing, and maintaining our various industrial products

THE COURSE—A Statement

It has not been the aim to develop a course of study complete in all of its details, but rather to outline the various fields that should become parts of the curricula and to lay a background of general and specific objectives upon which to build.

Outline analyses of shop activities have been made, and from these analyses the department has endeavored to draw suitable material to offer in the various courses. The development and organization of necessary textual and informational material must follow this present endeavor.

The four column horizontal plan of outline has been adopted for the Industrial Arts courses. The desired realization of specific objectives centers in the first column, which column is divided vertically into Knowledge, Appreciation, Habits and Ability.

The selection of various teaching units has been a problem. In some cases it seemed natural to center a unit of instruction around a tool process. Again the material or medium occupied the stage and yet again a special problem or project appeared to become a natural division.

As to the selection and division of subject matter, such questions had to be considered as—Which of the many manual activities shall be taught? Are some more fundamental than others? How shall we classify industrial arts? What shall constitute a sound basis for choice?

It is evident that the school cannot furnish a set up for each of the many specialized activities even in its own community, nor would such a set up be necessary for a general occupational study. The best procedure calls for the selection of a few representative fields that open the way for a basic knowledge of the many specialized industries. Such general representative activities seem naturally to center around the mediums used—wood, metals, paper, clay, textiles, etc.

Mr. Bennett's early classification of industrial arts is natural and clear cut:

1. The graphic arts.
2. The mechanic arts.
3. The plastic arts.
4. The book-making arts.
5. The textile arts.
6. The culinary arts.

The graphic arts include the various aspects of drawing as the universal language of industry.

The mechanic arts is the largest field. It includes all of the industries that make use of wood, metals, and machinery.

The plastic arts take in the whole field of the ceramic industries, which use earthy materials.

The book-making arts comprehend all forms of printing, engraving and bookbinding.

The textile arts include spinning, weaving, braiding, dyeing, basketry, knitting, sewing, etc.

The culinary arts, which some think to be more a science than an art, has to do with all phases of the selection, preparing and preserving of foods.

In the following diagram are listed the divisions that can be justified as Junior High School shop subjects. A star indicates the ones that are now included in the course of study as exploratory activities:

1. THE GRAPHIC ARTS
   1. Freehand drafting*
   2. Mechanical drawing*
   3. Blueprint reading*
2. THE MECHANIC ARTS (Constructive Arts)
   1. Woodwork*
      1. Benchwork joinery*
      2. Mill cabinet work
      3. Pattern making
      4. Carpentry
      5. Woodcarving
      6. Wood turning*
      7. Wood finishing*
   2. Upholstery
   3. Sheetmetal*
   4. Bench metal work*
   5. Machine Shop work*
   6. Auto Mechanics (Instruction course
   7. Electricity*
      1. General electric work*
      2. Auto electrics
      3. Radio
3. THE PLASTIC ARTS
   1. Cement and concrete work
   2. Brick and stone masonry
   3. Pottery
4. THE BOOK-MAKING ARTS
   1. Printing*
   2. Engraving
   3. Bookbinding
5. THE TEXTILE ARTS
   1. Loom weaving
   2. Basketry
   3. Sewing
6. THE CULINARY ARTS

The general shop type of instruction has been approved especially for Junior High Schools where only one to three shop instructors can be employed. It will be necessary for each teacher to handle from two to four activities on the activity group plan. Since the twenty-week unit has appeared to be the best minimum time required to explore one activity, it seems advisable to let the seventh and eighth grades constitute a unit for giving the exploratory work in the five activities offered.

Five beginners' courses, as follows, have been planned, each covering one semester.

Low 7th Grade—The drafting activities.
High 7th Grade—Bench woodwork.
Low 8th Grade—Bench metal work.
High 8th Grade—Sheet metal (optional)
High 8th Grade—Electrical work (optional)

The ninth grade will provide for choice of activity, specialization and project work based upon the results of the previous exploratory work.

It is believed that the home mechanics aims should permeate all of the shop work and that home jobs should become a by-product rather than a separate department of Industrial Arts teaching. Certain one-teacher general shops may be an exception to this rule.

Grateful acknowledgement is made to the many persons from whom help has been received in the formation of these outline courses.

APPRECIATIONS TO BE DEVELOPED BY INDUSTRIAL ARTS WORK

An Appreciation of—

The value of perseverance
The necessity for individual thinking
One's abilities and possibilities
Character elements in relation to all forms of good habits
Good health and physical fitness
The value of work and effort on one's character and physical fitness
The satisfaction from work well done
The art of reading. All knowledge is recorded somewhere in the pages of books
The meaning of perfection and its scarcity
All forms of useful knowledge
The value and help of printed instructions
Careful preparation and forethought, before attempting anything of importance
The ability to get along with others
The satisfaction from having done one's best
The difference between strength and skill
The value of alertness—being awake
Our natural resources, resulting in a desire to conserve them
The need for caution and the danger of carelessness
The necessity for accuracy and the value of it
The value of skilled labor, compared with unskilled—to the individual and the country
Cooperation and teamwork in our modern industrial world
Economy of time and material versus waste
Things which delight the senses. Sight of crotch veneer, Smell of Cedar, feel of sugar pine
Work as a factor in stable society
The idea that if skill is difficult to acquire it is the more valuable when acquired
Quality and fineness in materials
Sharp tools, their adjustment, care, and performance
The labor-saving value of machinery
Good design
The value and cost of equipment and materials
Originality in design or style
Harmonious color schemes

A GENERAL SHOP UNIT

This is a general unit of instruction involving shop standards pertaining to the physical set-up and working conditions of the shop. The subject matter of this unit cannot be put over in a certain time allotment in a certain grade, but should become educationally effective wherever and whenever a pupil comes in contact with the physical conditions here outlined. We are primarily concerned with ideals, attitudes, and habits in all of our industrial arts work. Therefore, for high developmental aims, the instructor is concerned with correct physical conditions in his shop.

JUNIOR HIGH SCHOOL SHOP STANDARDS

Pertaining to the physical set-up and working conditions of the shop

General Condition

1. The arrangement of benches, lockers, racks and equipment, should furnish the maximum room, ample light, freedom and safety for shop work
2. The floor and corners and edges of the room should be kept free from boxes, cans, scraps, and disorganized supplies. Nothing should impede janitor service. The shop should be tidy and not messy
3. Store rooms, lumber and metal racks, shelves, tops of lockers and cupboards should be kept orderly and free from useless and unorganized supplies and materials
4. Shop reference books, texts, instructional sheets and forms should be organized and systematically handled
5. Pictures, flags, mottos and other posted materials should be kept in order and not allowed to take on a neglected appearance
6. Patterns, templets, charts and other teaching devices should be kept in their proper places and organized for definite educational use
7. Machine accessories such as clamps, gauges, wrenches, fences, etc., should be systematically cared for
8. The teacher's desk should be an example of orderliness
9. Blackboards and bulletin boards should be kept free from obsolete and useless material. The material should be well organized and changed as the work changes
10. The general shop atmosphere should be such that it will inspire industry, thrift, and honesty, and command the respect of all. The personal appearance of the teacher and the conduct of the pupils are important factors

THE TOOL ROOM

SPECIFIC OBJECTIVES	SUGGESTIVE SET-UP AND PROCEDURE
1. To teach order and system in keeping and handling tools	The room should be adequate in size (at least 50 sq. ft. of floor space) with ample provision for light and ventilation The interior walls should be paneled smooth for profiling the tools Handy secure devices should be provided for holding the tools to the wall There should be provided a bank of sloping partitioned shelves for holding bits, files, screwdrivers, etc. An adequate and efficient device such as the numbered check should be used Tools should be grouped according to classification
2. To teach independence and responsibility	One boy only should be in the tool room during a class period The tools should be systematically checked and all tools, small or large, should be accounted for in good condition The tool keepers should be held responsible for seeing that all tools are returned to their proper places
3. To teach the correct tool vocabulary, including correct name, its pronunciation and spelling, names of parts, numbers and sizes	The tools should all be in sight The correct name of each tool should be posted in its proper place Current catalogues of tools can be of value to the tool keeper during spare moments Insist that all tools be called by their correct names
4. To teach the proper value, care, and reconditioning of the tools	The tool keeper should spend all of his period in checking the tools in and out, and in keeping the tools and toolroom in order Broken parts, bits, drills, taps, etc., should be accounted for. Pupils should know the reason for the breakage The tools should be well cared for, kept free from rust, sharpened and oiled Unless the instructor has a well-developed and functioning honor system, the tool room should be kept locked when not in use

CARE OF BENCHES AND EQUIPMENT

1. To instill high regard, appreciation and care for good tools, machines and other shop equipment	Benches, cupboards and machines should be kept clean day by day. This will inspire respect for the shop and its equipment and will facilitate the work of the janitors The benches should be protected from injury by carelessness or maliciousness Bench tops should be kept reasonably free from paint, acid stains, burns and toolmarks Tools, machines and other metal equipment should be kept constantly free from rust, corrosion, dirt or dried grease. The periodic polishing with an oily cloth will insure an acceptable condition

2. To teach the importance of prompt repair and the reconditioning of damaged shop equipment	Bench tops should be sanded and refinished periodically All broken or damaged parts on benches, vises and other equipment should be reconditioned immediately Painted portions of tools, sheet metal stakes and machines should be repainted when necessary All tools and machines should be kept well-sharpened and properly adjusted

HANDLING SUPPLIES

1. To teach system, order and economy through the handling of supplies	Small supplies, such as nails, screws, brads, sandpaper, solder, rivets, etc., should be organized and systematically dispensed by the toolkeeper Large supplies, such as lumber, iron, sheet-metal, paints, oils, rags, etc., should be conveniently kept in suitable racks and lockers, and organized for systematic handling outside of the toolroom The organization of supplies should involve: a. Guarantee against waste b. Protection against personal injury c. The requiring of a minimum of time on the part of the instructor in handling supplies d. The facilitating of janitor work e. Ordering of only standard and required supplies in such quantities that will not cause a cluttered condition in the shop
2. To teach the correct names, kinds, sizes and numbers of the various supplies	Have samples of the various supplies organized on display boards clearly revealing the kinds, sizes, gage, etc. Have the supply drawers and bins properly labeled in the toolroom

SELECTION OF PROJECTS

1. To inspire interest in the job and call out a boy's best endeavor	All operations upon the project should be within the range of the pupil's ability The project should be of interest to the pupil and useful to someone Model projects should be carefully selected, well made, and used to stimulate interest and technical knowledge and under no circumstances should they be used as templets
2. To teach a maximum of well-organized educational material concerning tools, materials and processes	The project must be suited to the particular unit of study in subject matter and tool processes Materials should be suited to the project in kind, quality, and cost The project should call for correct tool processes and meet ideal craft standards of joinery and tool treatment

3. To develop ideals of workmanship and habits of economy in time and materials	The work should not consume more time than is justifiable for its place in the particular unit of the course of study
	Slipshod or careless workmanship should not be justified upon the child's supposed lack of ability, neither should such work leave the shop
	Projects should not be kept to clutter up the shop. Poor workmanship or inability to pay for materials are the usual causes for abandoned projects. Careful planning and supervision will be necessary to remove this evil
	Waste should be kept to a minimum
4. To develop the artistic taste and originality	The project should meet artistic standards in form, design, and decoration
	The project should follow conservatively the modern trend in style. The instructor should seek to draw out the imagination and inventive powers of the pupil
	Originality in style, design, and decoration should be cultivated under intelligent guidance

FINISHING METHODS

1. To teach the importance of selecting the finish that will suit the project	The finishing method should conform to the requirements of the particular unit of the course of study
	The finish of a project should be suited to its material in nature, use, and cost
2. To develop the artistic sense and certain craft standards	The natural beauty of the material should be enhanced, not lost
	Harmony in tone and color should be insisted upon
	The finish and decoration should follow conservatively a modern trend
	The preparation, application, and preservation of finishes should meet ideal standards of the craft
3. To teach the proper care of finishing materials	All finishing supplies should be kept in appropriate containers and cupboards out of sight and organized for systematic handling Paint, stain, and shellac containers should be kept clean and well closed
	Paint brushes should be thoroughly cleaned after using
	Care should be taken to protect benches, tools, walls, and floor from becoming soiled
	Finishing operations should be preceded by instruction and demonstration to assure proper handling of materials

Mechanical Drawing Beginners' Course

MECHANICAL DRAWING—BEGINNERS COURSE

Twenty weeks of five one-hour periods, Seventh or Eighth Grade (Required)

UNIT I. INTRODUCTION TO THE ACTIVITY AND ITS TOOLS OF EXPRESSION

Specific Objectives	Subject Matter	Suggested Teaching Procedure	References for Teacher
KNOWLEDGE of The proper names of the simple tools and materials Care of the materials and tools Shop rules regulating conduct and procedure in class APPRECIATION of The importance of the field The difference between good and inferior work HABITS Laying a foundation of knowledge and action upon which to build good drawing habits ABILITY To properly attach and detach drawing paper with reference to the drawing board To correctly use the simple tools	Drawing A Universal language Place in industry Place in everyday life Equipment and supplies Table Drawing board Tee Square Triangles 30°-60° and 45° Scale or rule Eraser Pencil Compass Thumb Tacks Paper Border lines	Introductory talk by the teacher Exhibition of a few good drawings Have equipment and paper passed out Name and discuss briefly the tools and supplies Demonstrate Position of hand Posture at the desk Placing of paper upon board Sharpening pencils Use of the simple tools How to lay out a border Discuss care of the tools and supplies Discuss the rules of the shop with reference to the drawing activity	"General Mechanical Drawing," McGee & Stutervant, pp. 1-6 7-10 "Mechanical Drawing," Teacher's Manual, Rigast pp. 5-17 "Grammar Grade Problems," Bennett pp. 10-12

UNIT II. THE ALPHABET OF LINES

Specific Objectives	Subject Matter	Suggested Teaching Procedure	References for Teacher
KNOWLEDGE of Nature and use of the (6) lines—Border, visible, hidden, center, extension, dimension APPRECIATION of Quality in line work Need of clean hands Good pencil performance HABITS Still laying foundation of knowledge and action for the good habits of Cleanliness Neatness Correct posture Correct use and care of tools Orderliness ABILITY To use the tools in executing the six kinds of lines	Lines Horizontal Vertical Slanting Border Visible Hidden Center Extension Dimension Methods and procedure for constructing the above lines Finished plate containing the alphabet of lines	Discuss the six kinds of lines Nature and Use Present good model plates of line work Present a drawing showing the use of the various lines Demonstrate the making of the lines, giving heed to Tool use Posture Pencil performance Clean hands Conduct a period of practice Have pupils use the bordered sheet from Unit I and make a finished plate containing the alphabet of lines. Carefully supervise individual work	"Mechanical Drawing," Teacher's Manual, Rigast pp. 40-42

Specific Objectives	Subject Matter	Suggested Teaching Procedure	References for Teacher
KNOWLEDGE of The elements requisite to good lettering APPRECIATION of The desirability for good lettering The difference between good and poor lettering HABITS Still laying the foundation of knowledge and action for the good habits of Carefulness Neatness Cleanliness Correct posture Correct stroke ABILITY To make acceptable capital letters, figures, and arrowheads for simple drawings	Letters Gothic Slant 68° 3/16 Capitals and figures Arrowheads ratio 1:2 Position of paper Posture Strokes Slant Stability Spacing 1 to 4 lettering plates	Briefly discuss the desirability for good lettering Present plates or models showing the use and beauty of good lettering Demonstrate how to letter, giving heed to Position of paper Posture Stroke Slant Stability Spacing between words and between sentences Pass out lined paper and conduct a period of practice Direct the making of one to four plates of lettering containing Border Lines for lettering Grouped letters Words Sentences Figures Arrow heads	"Mechanical Drawing," Rigast pp. 1-4 Text. pp. 1-10 "Gen. Mechanical Drawing," McGee & Stutervant, pp. 39-43

Specific Objectives	Subject Matter	Suggested Teaching Procedure	References for Teacher
KNOWLEDGE of The use and relation of views The correct procedure in representing rectangular objects APPRECIATION of The application of conventional lines The need of accurate measurements HABITS of Still laying the foundation of knowledge and action for development of the good habits of Correct handling of tools Accuracy Neatness Self-direction, etc. ABILITY To visualize To use the common drawing tools in correctly representing rectangular objects in three views To correctly dimension the drawing made	Orthographic projection Relation of views Laying out Centering the drawing Classification of lines Dimensioning Lettering 4 to 12 plates	Explain the meaning of Orthographic Representation, using the projection box Review the study of lines and their present application Present a good drawing of a rectangular object Demonstrate the correct way to lay out a three view rectangular drawing giving heed to Visualization Correct use of tools Centering drawing Direct the work of making 4 to 12 plates in this group according to the ability of the pupil Use model blocks and isometric views to guide the work Supervise individual work, keeping in mind the demands of the specific objectives Stress relation of views	"Grammar Grade Problems," Bennett pp. 11-31 "Mechanical Drawing," Teachers' Manual Rigast pp. 43-49 "General Mechanical Drawing," McGee & Stutervant pp. 15-17

UNIT V. ORTHOGRAPHIC REPRESENTATION—ANGULAR GROUP. INCLINED LINES

Specific Objectives	Subject Matter	Suggested Teaching Procedure	References for Teacher
KNOWLEDGE of The degree of angles 30, 60, 45, 90 The use of the drawing triangles in executing plates involving the above angles APPRECIATION of The application of inclined lines The need of care and accuracy in handling the triangles and tee square HABITS Emphasis upon Concentration Visualization Thinking through to solution ABILITY To use the common tools, including triangles, in executing drawings involving inclined lines and angles other than right angles To correctly dimension these drawings	Orthographic Projection (Cont.) Relation of views Laying out Retracing Dimensioning Lettering 4 to 10 plates	Clear up any failures to understand the relation of views Present and discuss a model drawing involving inclined lines and angles of varying degrees Demonstrate the use of the Triangles in laying out drawings of this group Direct the work of 4 to 10 plates in this group Use model blocks and isometric views to guide the work Supervise individual work	"Grammar Grade Problems." Bennett pp. 34-35

Specific Objectives	Subject Matter	Suggested Teaching Procedure	References for Teacher
KNOWLEDGE OF The Circle, its nature, measurements, and use of: degree, angle, segment, tangent, arc, center lines, chord, and quadrant How to use the compass. How to lay out circular drawings APPRECIATION OF The circle as a thing of beauty and rhythm The need of care and accuracy in executing circular work HABITS Constructive imagination Application Accuracy ABILITY To use the common drawing tools to lay out and finish orthographic drawings involving the circle	The Circle: Circumference Diameter Radius The degree system: Angles Tangents Segments Arcs Center lines Chords Quadrants The Compass Lay-out of circular views Dimensioning circular views 4 to 12 Plates	Direct a brief study of the circle, its parts and measurements Present and discuss one or more good drawings involving the use of the circle Demonstrate the use of the common drawing tools in laying out circular work Give special emphasis to the use of the compass. Use models, isometric views or incomplete drawings to guide the work Direct the making of 4 to 12 Plates in this group Supervise individual work Some good habits should be pretty well established by this time.	"Grammar Grade Problems," Bennett pp. 48-59 "General Mechanical Drawing." McGee & Sturtevant, pp. 12-14, 25-27 "Simplified Mechanical Drawing." Crook pp. 98, 99

UNIT VII. BLUE-PRINT READING

Specific Objectives	Subject Matter	Suggested Teaching Procedure	References for Teacher
KNOWLEDGE The knowledge gained in the previous six units should prepare the pupil for the first steps in this unit Knowledge of any new symbols of terminology introduced APPRECIATION of The value of clearness and accuracy in the drawing in order to facilitate accurate reading The use of blue-prints in the industrial field. The value educationally HABITS The habits of concentration, visualization and self-direction, sought for in the preceding units will now play a useful part ABILITY To read and interpret simple blue-prints and working drawings	Drawings and Blue-prints Nature Use in industry Value educationally Value avocationally Qualities essential for accurate reading Visualization Concentration Constructive imagination Problems: Solving from 4 to 15 simple blue-print reading problems	Briefly discuss the nature, value and uses of blue-prints Emphasize the qualities of thinking, necessary to read and solve any blue-print reading problems. Exhibit several real blue-prints and discuss Emphasize again "Drawing as a universal language" Present the problems in order of difficulty Lead the pupils to think for themselves Give opportunity for the pupils to study their corrected papers	"Primer of Blue-Print Reading" Diamond

Specific Objectives	Subject Matter	Suggested Teaching Procedure	References for Teacher
KNOWLEDGE of The knowledge previously gained of orthographic projection and isometric form, will be very useful in this unit Some idea of perspective Working methods and strokes essential to free-hand drafting APPRECIATION of The value and uses of Free-hand sketching HABITS Emphasis upon the previously mentioned qualities especially: Constructive imagination Visualization Neatness ABILITY To sketch an object in isometric and orthographic form, free-hand and dimension it properly To think through the pencil	Uses of free-hand drawing Free-hand lines, arcs, and circles Model sketches Perspective view Lettering Dimensioning Material and Methods Problems for practice 2 to 8 Plates The original Problem	Discuss the scope of the work and its practical uses Exhibit good specimens of free-hand drafting Demonstrate the freehand stroke with methods and movements in making lines, arcs, and circles Give time for drill in these movements Direct the work on problem plates. Use the last two days on an original problem Pupil selects a simple article in the room and makes a plate including: Border Isometric view Orthographic drawing Dimensions Lettering All work free-hand Supervise individual work	"Free-hand Drafting." Zipprich "General Mechanical Drawing." McGee & Sturtevant. pp. 44-47

Woodwork Beginners Course

WOODWORK—BEGINNERS' COURSE

Twenty (20) weeks of five one hour periods. SEVENTH GRADE—Required

UNIT I. SHOP ORIENTATION AND TOOL CLASSIFICATION

Specific Objectives	Subject Matter	Suggestive Teaching Procedure	References for Teacher
KNOWLEDGE of— Shop rules and regulations Shop Systems Safety precautions Tools and their classification APPRECIATION of— A systematically arranged Shop Orderly tool keeping. Good shop sense Opportunity here afforded Rights of others HABITS—Laying the foundation for the development of good habits viz: Co-operation, caution, orderliness,, openmindedness, and industry ABILITY—To co-operate with teacher and pupils in carrying out shop regulations and working procedure To know tools by their correct names and uses	Enrollment data Shop systems Lockers Tool room Shop tickets Foremen Shop Rules and Regulations Entering and leaving Shop Shop behavior Relation with teacher, foreman, toolkeeper and other pupils Shop Precautions: Running in the Shop Distracting attention Relation to machines Care with hand tools Safety first hints First aid Classification of the woodworking tools 1. Laying-out tools 2. Cutting tools 3. Holding tools 4. Boring tools 5. Driving tools 6. Abrasive tools Tests in spelling, pronunciation and classification of the tools A true-false test upon the subject matter	Secure enrollment data. Assign benches Seek to inspire an appreciation of the opportunities now offered Lead pupils to feel their responsibility Pass out copies of shop regulations and discuss briefly Explain the shop systems Conduct pupils on a tour around the shop pointing out the dangers and safety precautions Briefly discuss the work to be accomplished in tthe course. Seek to lay the foundation for certain appreciations and desirable habits Present pupils a list of the tools properly classified for study As enrichment work for some pupils have them prepare a small scrap book of pictures of the tools properly grouped Other pupils can read certain reference material Have pupils participate in handling the tools and separating them into their proper classifications Test the pupils by presenting a mixed list of the tools for classification	"Woodwork in the Junior High Schools." Roberts, Chap. 1, 2, 3 "Instructional Units in Hand Woodwork" Brown and Tustison Foreword and Introduction "How to work with Tools and Wood." Stanley, Chap. 1 "Essentials of Woodworking" Griffith, Chap. I—V "Principles of Woodworking." Hjorth, Chap I "Prevocational and Industrial Arts." Wood and Smith, pp. 3-34 'Tool Processes in Woodwork." Laughlin, Chap I—III

UNIT II. PLANING AND SQUARING

Specific Objectives	Subject Matter	Suggestive Teaching Procedure	References for Teacher
KNOWLEDGE of Plane adjustment Posture at bench Stroke, angle and pressure in handling plane The (6) step method of squaring up stock How to whet a plane iron APPRECIATION of The difference between a dull or badly adjusted plane and one in good condition The value of thin ribbon-like shavings The importance of accuracy HABITS Attentiveness Carefulness Self-reliance Regard for tools and benches ABILITY to Properly adjust a plane Use the jackplane correctly To use the laying-out tools, jack plane and bench saw To properly square-up stock	Planing The jack plane The vise Soft pine board Plane adjustment Posture at bench Stroke. Face planing Edge planing End planing The (6) step method for squaring stock The laying-out tools Rule Try square Knife Marking gauge Use of— Bench vise Bench hook Bench saw Projects Sand block Bread board A true-false test on squaring	Give each boy a scrap piece of soft wood. With planes dull or mal-adjusted have pupils proceed to make shavings Now stop the work and have planes examined and adjusted Proceed again with instructions as to posture, stroke, angle, etc. Direct practice in end-planing discussing methods of avoiding damaged corners Explain and demonstrate the (6) step method for squaring Give each pupil a piece of soft-wood about 1x4x13 Rough Using the (6) step method, have the pupils finish the piece to ¾x3½x12 With proper laying-out tools, have pupils lay out half of the piece in ¼" sections around the block for a sawing exercise. The pupil should test his own skill by observing the sawed-off pieces and the condition of the board after each sawing The remaining half can now be used to make a sand block of desired size Test for Unit II	"Instructional Units in Hand Woodwork" Brown and Tustison Units 4, 5, 6, 7, 10, 13, 14, and 15 "Essentials of Woodworking." Griffith, pp. 39-48 "Tool Processes in Woodwork." Laughlin, pp. 28-33 Squaring Chart—Lukowitz Charts No. 101, 103, 111, 114, 115, 116—Stanley "Principles of Woodworking." Hjorth, pp. 70-72

Specific Objectives	Subject Matter	Suggestive Teaching Procedure	References for Teacher
KNOWLEDGE of The difference between the common edge cuts, Chamfer, Bevel, Taper and Round. The use of the hand tools in executing these cuts APPRECIATION of The utility and beauty resulting from these various arris treatments. The importance of accuracy in executing these processes HABITS of Clear thinking. Accuracy in performance. Attending strictly to one's own work Close attention to instructions ABILITY to Properly lay out and successfully execute the edge cuts—Chamfer, Bevel, Taper, and Round	Squaring (Reviewed) Chamfering Pencil gauging Planing chamfer End planing Beveling Tapering Rounding Hollowing Beading New Tools T Bevel Bench stop Pencil gage Straight edge Compass Projects Confined to one main piece Coat and hatracks Bases for ringtoss Calendar pads, bill file, etc Orthographic drawing of the one-piece projects to be made A true-false test on arris treatments	Give pupil any scrap piece of soft wood for practice By drawings, demonstrations, and models, seek to teach the fundamental steps in chamfering beveling, tapering and rounding. Demonstrate the setting and use of the new tools Conduct a period of drill upon the laying out and making the arris cuts Have pupils make a list or tell where these arris treatments can be used for beauty or utility in woodwork After sufficient practice have pupils choose and draw one or more one-piece projects and supervise the work of squaring the wood and submitting the arrises to the desired treatments. The one-piece projects may be carried over into Unit IV if the boring of any holes is needed Test for Unit III	"Instructional Units in Hand Woodwork" Brown and Tustison Units 14, 15, 16 "Essentials of Woodworking," Griffith, pp. 48, 50 "Tool Processes in Woodwork" Laughlin, pp. 37, 38 "Woodwork in the Junior High School." Roberts, p. 111 "Principles of Woodworking." Hjorth, p. 182

Specific Objectives	Subject Matter	Suggestive Teaching Procedure	References for Teacher
KNOWLEDGE of How to lay out for boring holes. The nature and use of the various boring devices. How a bit cuts. APPRECIATION of The difference between skillful and careless boring. A properly sharpened bit or drill. HABITS of Carefulness with reference to, Breaking through the wood when boring. Boring straight and square. Damaging bits on iron vise and otherwise. ABILITY to Accurately lay out for boring desired holes. To identify bits and drills as to kind and size. To use the hand boring devices correctly.	Laying out for boring holes Try square Marking gauge Rule and pencil Use of the brace Operation of chuck Use of the ratchet Meaning of sweep Sighting while boring Bits and drills Judging kinds and sizes Judging condition Drilling for screws Hole for body of screw Pilot hole Use of countersink Use of hand drill Expansive bit Forstner bit Projects Further development of pieces from Unit III. Game boards, spool racks, ring toss, line winder, etc	Briefly discuss the boring unit making it clear that all of the hand boring devices will be studied, but special drill for mastery will be confined in this unit to the brace and auger bit. Conduct a brief study and comparison of the boring devices listed in subject matter column Demonstrate how to lay out and bore holes using the brace and auger bit Conduct a period of practice on scrap pieces Have pupils finish certain pieces started in Unit III Fast pupils can study assigned references applicable to the boring unit and practice using the boring tools A true-false test can be used to test the knowledge acquired	"Instruction Units in Hand Woodwork" Brown & Tustison Units 22 and 23 "Principles of Woodworking." Hjorth, pp. 18-21. "Essentials of Woodworking." Griffith, pp. 53, 55. Stanley Chart No. 117

FINISHING (1)

Specific Objectives	Subject Matter	Suggestive Teaching Procedure	References for Teacher
KNOWLEDGE of The nature, action and use of waterstain, and shellac. Steps to take in using these finishing mediums APPRECIATION of A finish that will preserve or enhance the natural beauty of the wood The difference between good and poor work in finishing HABITS Thoroughness in preparing surface Neatness in the work Attentive to instructions Cleanliness with reference to hands, brushes and surroundings ABILITY to Prepare a surface properly for finishing To use one or more of the common mediums for neatly finishing simple pieces of woodwork	Water Stains Nature Properties Use Value Shellac Nature Properties Use Value Thinners Water Alcohol Cleaners Water Alcohol Sand paper and steel wool Rags—their use and care Brushes Selection Use Care Preparation of surfaces Preparation of finishes Projects Finishing the simple pieces made in previous units	Briefly introduce the first finishing unit and seek to inspire an appreciation of good finish and a desire to do one's best in accomplishing it. Display and discuss samples of the finishes to be studied Conduct a brief study of the (2) mediums Demonstration—Let the pupils see an expert apply finish Demonstrate the use of thinners and brush cleaners Have pupils finish their pieces previously made, using parts of three days to allow for drying between coats Fast pupils can be given special assignments for study A true-false test should be given to ascertain the results gained by the work in this unit	"Coloring, Finishing, and Painting Wood." Newell, Chap. III, pp 173-183 "Tool Processes in Woodworking" Laughlin, Chap X. "Essentials of Woodworking" Griffiths, Chap. XIII "Principles of Woodworking" Hjorth, Chap XVI

UNIT VI. SQUARING (Cont.) ASSEMBLING AND FASTENING

Specific Objectives	Subject Matter	Suggestive Teaching Procedure	References for Teacher
KNOWLEDGE of The Butt joint The fastening devices, kind, size, and use The use of the assembling tools APPRECIATION of The need of choosing the type of fastening to suit the job, taking into account kind of wood, beauty and durability HABITS Economy in use of glue, brads, screws, etc Fore-thought and preparation Accuracy and neatness Honesty in effort ABILITY To use the assembling tools and simple fastening devices. To put the squared pieces of wood together in proper butt-joint formation.	Squaring (Reviewed) Fastening devices Kinds nails brads screws glue corrugated fasteners Sizes Appropriate use Assembling tools Hammer Nail set Hand drill Screw driver Counter sink Clamps Vise Try square Projects A variety of small boxes, stationary holder, etc., articles containing several squared-up pieces put together with the butt-joint Original design Reading a working drawing	Briefly introduce the unit showing its close relation to Unit II on squaring up stock Explain the butt joint and discuss its use. Conduct a brief study comparing the common fastenings Use chart for nail, brad, and screw sizes Discuss the use of glue alone and with nails in connection with butt joints Demonstrate the use of the proper tools in assembling pieces in butt joint formation Guide in the selection of projects. Have pupil make a freehand dimensioned sketch and correct bill of materials covering article to be made Extra reading assignments and other projects may be chosen to enrich the work of fast pupils An appropriate true-false test should again be used	"Instructional Units in Hand Woodworking." Brown & Tustison Units 27 and 28 "Tool Processes in Woodworking." Laughlin, pp. 43-50 Various screw and nail charts from commercial firms Stanley Charts No. 118, 119 Glue Chart—Wilhelm Glue Company

UNIT VII. SHAPING

Specific Objectives	Subject Matter	Suggestive Teaching Procedure	References for Teacher
KNOWLEDGE of The new tool processes How to use a templet How to lay out curves of different kinds How to whet a chisel APPRECIATION of A sense of balance and symmetry in form Coordination of hand and eye in hand shaping Wood texture and "way-of-the-grain" HABITS of Paying close attention to instructor or job sheet Care in inspecting tools for edge and adjustment. Originality in design and self-reliance in work Cooperation with others ABILITY To design and cut a templet. To lay out and cut a circle and an ellipse To use the hand tools to cut curved and irregular shaped pieces	Design and its relation to good projects The circle The ellipse String method lay-out Irregular curves Templets Tools Compass Coping saw Turning saw Spoke shave Wood files Plane Draw knife Chisels Sloyd knife Operations Hand processes using the above tools to shape irregular pieces after templet or mechanical layouts Use of sandpaper Best wood for shaping Projects Cutting boards, tie racks, shelf brackets, book ends, towel rack, weather-vanes, toy animals	Introduce the new unit of shaping by a brief discussion of design using the blackboard Demonstrate how to lay out the circle, the ellipse, round corners, and irregular curves Now have pupils choose a project and develop a pattern or templet. Discuss and demonstrate the use of the hand shaping tools Certain reading assignments may be given on the tool processes. Discuss the best woods for shaping purposes Demonstrate whetting a chisel and its use for paring round corners or curves Give the usual warnings about the wrong use of files and sandpaper. Require a free-hand sketch of project to be made Correct principles of squaring and assembling should be insisted upon An appropriate test should close the unit	"Instruction Units in Hand Woodwork" Brown & Tustison Units 19, 20, 21 "Woodworking in the Junior High School" Roberts, Chap. III. "Essentials of Woodworking." Griffith, Chap. VI "Tool Processes in Woodworking." Laughlin, pp. 40, 41 Stanley Charts No. 112, 113, 120, 121

UNIT VIII. SQUARING (Continued). POLYGONS AND HALF-LAP JOINT

Specific Objectives	Subject Matter	Suggestive Teaching Procedure	References for Teacher
KNOWLEDGE of The methods for laying out the polygonal forms Steps necessary to the construction of an acceptable half-lap joint APPRECIATION of The beauty of polygon forms. The need of accurate lay-outs The many uses for the half-lap joint HABITS of Thoughtfulness in planning the solution of the problem Accuracy in cutting to a line Counting the cost in time and money ABILITY to Lay out and cut polygon shaped pieces To execute successfully the half-lap joint To assemble the treated pieces into a useful article	Squaring (Reviewed) Polygons Hexagonal lay-out Octagonal lay-out Tools for special study Compass Dividers Triangles T-Bevel Firmer chisel The half-lap joint Lay-out Execution Projects Tea stands Plant stands	Introduce the unit of work and explain the methods for laying out the hexagon and octagon Review squaring Have pupils select and plan their project Demonstrate how to lay out and cut the half-lap joint Conduct a practice of half-lap construction on scrap pieces Seek to develop originality in design as may apply to any decoration on the top of the stand or the shape of the feet Insist upon a free-hand dimensioned sketch or working drawing of the project to be made On the same plate should appear an accurate list of materials Closely supervise individual work to avoid the development of bad tool habits Give the test for the unit	"Tool Processes in Woodworking." Laughlin, pp. 18 and 19 "Essentials of Woodworking." Griffith, pp. 206, 207, 104 "Instructional Units in Hand Woodworking" Brown & Tustison Unit 32 Stanley Charts No. 102, 108, 109, 110

UNIT IX. FINISHING (2)

Specific Objectives	Subject Matter	Suggestive Teaching Procedure	References for Teachers
KNOWLEDGE of How to prepare a surface for finishing The nature and use of linseed oil and wax Steps to take in using these finishes APPRECIATION of The beauty of properly applied finishes The three-fold use of wood finishing 1. Beauty 2. Utility 3. Preservation HABITS of Carefulness in Thinning and stirring medium Using medium sparingly Care of brushes Attentiveness to instruction Cleaning up ABILITY to Prepare a surface Mix and apply water stain To apply shellac properly Rub down one coat preparatory to the next Apply prepared wax as a finish Judge quality in finish	Water stains (Reviewed) Linseed oil Nature Properties Use Value Shellac (Reviewed) Prepared Wax Nature Properties Use Value Thinners and cleaners Water Alcohol Turpentine Sandpaper and steel wool Rags—Their use and care Brushes Selection Use Care Preparation of surfaces. Preparation of finishes. Projects Finishing the pieces made during the study of Units VI, VII, and VIII	On introducing the second unit of finishing, seek again to inspire an appreciation for good finish and avoid the formation of bad habits Assign special informational readings Display and discuss samples of finish to be studied Review "waterstains" and "shellac" Demonstrate again the application of the simple finishes Preparation of mediums Use of thinners Application Care after application Cleaning of brushes Care of paint rags Have pupils finish projects they have made during Units IV-VIII. Fast students can be given special references for study Carefully supervise work Emphasize proper preparation of the surface Use of sandpaper Use of steel wool Give test for the unit	"Coloring, Finishing and Painting Wood." Newell "Principles of Woodworking" Hjorth, Chap. XVI "Essentials of Woodworking" Griffith, Chap. XIII "How to Work with Tools and Wood" Stanley, Chap. XI

Specific Objectives	Subject Matter	Suggestive Teaching Procedure	References for Teachers
KNOWLEDGE of The qualities and use of the common commercial woods The best wood for certain purposes APPRECIATION of Our natural timber resources, resulting in a desire to conserve them Of the natural beauty of different woods HABITS Pupil should form the habit of acquiring as much information as possible about the materials with which he works ABILITY to Identify at sight the common soft and hard woods	The common soft woods Nature Habitat Properties Use Value White pine Sugar pine Douglas fir (Oregon pine) Red fir Redwood Poplar White cedar Spruce The common hardwoods Nature Habitat Properties Use Value Oak Gum Maple Walnut Mahogany Red Cedar Birch	Open the unit by a brief discussion of our common soft and hard woods Display and discuss the samples of soft and hard woods Assign readings on the study of the woods as to Nature Habitat Properties Use. Value Be sure that pupils know the meaning of: Open grain, close grain, sapwood, heartwood, annual rings, bark, medullary rays, wormy Have samples numbered and pupils practice on identifying the woods on sight Conduct a discussion of the best uses for certain woods Give the unit test Enrichment material— Conservation material Advanced readings	"Principles of Woodworking." Hjorth, pp. 223-250 "Essentials of Woodworking." Griffith, pp. 136, 147, 162-174. "Wood and Forest" Noyes "Wood and Lumber" Newell "Materials of Industry." Mersereau, pp. 1-59

UNIT XI. FORESTRY, LUMBERING, MILLING

Specific Objectives	Subject Matter	Suggestive Teaching Procedure	References for Teacher
KNOWLEDGE of The location of our forests Conservation laws Best trees for lumber Lumber and mill terms How and where to buy lumber APPRECIATION of The importance of Forestry laws The importance and scope of our lumber and mill industries HABITS The pupil develops studious habits of looking up technical and related information Conservation habits Exactness in specifying ABILITY To choose lumber intelligently for certain purposes, considering the amount, sizes, kind, cut and finish required To write a bill of lumber	Our forests Location Conservation laws Reforestation Kinds of trees Logging Localtites Methods Tools Forest Products Building lumber Cabinet lumber Logs Stakes Posts Piles R. R. Ties Firewood Pulpwood Tanbark Milling Equipment Methods Lumber terms Lumber sizes Lumber grades Lumber conditions Lumber treatments Lumber finishing	Open the unit by a brief discussion of our natural resources Topics can be assigned for study and presentation The teacher who has had contact with forestry, logging or milling industries, has a rich background of experience from which to draw interesting material to develop this unit Collections of pictures and the use of moving pictures when available offer enrichment material for this unit Have pupils make lists of forest products Discuss wasteful methods of logging Discuss, illustrate, and acquaint the pupils with such lumber and mill terms as— Slabs, timbers, planks, boards, warp, wind, slash, and vertical grain, quarter-sawed, seasoned, kiln-dried, weather-checked, etc Discuss lumber grades as No. 1, clear No. 2, Common, sap clear, shop, mill-run, etc. Have pupils become familiar with lumber sizes and how to write a bill of lumber Discuss lumber finishes as: S1S, S4S, S1S1E, T & G, and moulding Give the test for the unit	"Principles of Woodworking." Hjorth, pp. 229-249 "Essentials of Woodworking" Griffith, pp. 148-161 "Wood and Forest" Noyes "Wood and Lumber" Newell "Materials of Industry" Mersereau, pp. 1-59

Specific Objectives	Subject Matter	Suggestive Teaching Procedure	References for Teacher
KNOWLEDGE of The required qualities for each form of joinery The best form of joinery to choose for the job Tool processes involved APPRECIATION of The good qualities of different forms of joinery The fact that glue alone will not make a weak joint strong The artistic value of certain forms of joinery HABITS Thoughtful discrimination Careful planning Accuracy ABILITY to Acquire the fundamental facts connected with joining wood for beauty and utility A degree of skill in manipulative work	Study of the common joints Practical uses Beauty Strength Durability Construction The butt joint The half-lap joint The dado joint The rabbit joint The dovetail joint The dowel joint The mortise and tenon The spline The use of these joints in the woodworking industries Note: This should not become the cold, formal, unmotivated joint work of the past, yet there is a danger of going to the other extreme. Joints will always be necessary. The subject matter of this unit in the hands of the wise teacher can become valuable and inspirational material.	Make clear to the boys the object of this unit Display good sample joints and illustrate how they are used in industry and shop Discuss with the pupils the strong and weak qualities of each of the (8) listed joints Have the pupils list the articles of wooden construction at home and at school wherein these joints are or might be used to good advantage Allow the pupils to handle the joints and become thoroughly familiar with them Make it clear that one or more of these forms of joinery will be used in the next unit and in most of the woodwork hereafter Conduct practice in the making of at least two of the joints, using scrap pieces Closely supervise the work, giving heed to the desirable habits Give the test for the unit	"Instructional Units in Hand Woodwork." Units 32-36. "Essentials of Woodworking." Griffith, pp. 98-119. "Principles of Woodworking." Hjorth, pp. 78-106. Stanley Charts No. 102, 108, 109, 110.

UNIT XIII. THE WOODWORKING PROBLEM

Specific Objectives	Subject Matter	Suggestive Teaching Procedure	References for Teacher
KNOWLEDGE of the Combined facts studied during past units Steps necessary in selecting, planning and constructing a worthwhile project APPRECIATION of The responsibility of using one's own resources in the mastery of a difficult problem HABITS Self-reliance Resourcefulness In fact, all of the desirable habits of the past units should now function ABILITY To use the facts and skills gained in past units To plan and complete an acceptable woodworking problem	The work of this unit will call for little that is new in the way of tools materials, and information, but the subject matter of the past units will now be called upon to function in a larger field New tools Rip saw Cross cut hand saw Steel square The choice of a problem. The working drawing and specifications Study of board measure The bill of materials The particular form of wood joinery to be used Projects Stools Stands Small Tables. Tabourets	This unit should be introduced as a real challenge to the boys They can now draw upon their own resources and the experience with the past units for the working out of a real worthwhile problem The use of new tools for getting out large pieces of stock should be demonstrated. Guide in the choice of a project to fit the ability of the boy. Have the pupil make a working drawing and write a bill of materials Conduct a drill on board measure. Discuss the best type of joinery to be used Seek to bring the desirable habits to a high point and strengthen the pupil's appreciation of his work Let the finished project be the test for this unit.	All of the reference books, previously referred to, have a bearing upon this unit

UNIT XIV. FINISHING (3)

Specific Objectives	Subject Matter	Suggestive Teaching Procedure	References for Teacher
KNOWLEDGE of The nature and action of the materials to be used The different forms of finish application APPRECIATION of The difference between good and bad finish as applied to wood The natural beauty of wood HABITS All of the desirable habits mentioned before should now be pretty firmly fixed ABILITY To choose, prepare and apply the common finishing mediums in an acceptable manner	Water stains (Reviewed) Shellac (Reviewed) Prepared wax (Reviewed) Paste filler Nature Properties Use Value Varnish Nature Properties Use Value Flat paint Nature Properties Use Value Enamel Nature Properties Use Value Thinners (Reviewed) Brushes, rags Sandpaper, and Steel wool (Reviewed) Finishing of projects	A special effort should be made in this final unit on finishing to make sure that all of the important information and steps of procedure have been put over and the weak points strengthened The old subject matter should be reviewed and the new discussed and demonstrated with care A thorough preparation of the surface before finishing should be insisted upon The information and demonstration can be put over to the class as a group, but the actual finishing of projects should be carried on with small groups to provide for close supervision Enrichment work for very capable pupils can be provided by special assignments The final finish work on all incomplete projects should be done in this unit Give the final test on finishing	"Coloring, Finishing, and Painting Wood" Newell "Principles of Woodworking." Hjorth, Chap. XVI

Bench Metal Work
Beginners Course

BENCH METAL WORK—BEGINNERS' COURSE

Twenty weeks of five one-hour periods—Eighth Grade—Required

UNIT I. THE CLASSIFICATION AND STUDY OF METALS

Specific Objectives	Subject Matter	Suggestive Teaching Procedure	References for Teacher
KNOWLEDGE of The common metals and alloys, their origin, value, properties and uses APPRECIATION of Our mineral resources resulting in a desire to conserve them HABITS To acquire inquisitive habits resulting in clear understanding of the subject being studied ABILITY To recognize and distinguish between the common metals and alloys	Ores Common Metals Iron Copper Lead Aluminum Tin Zinc Nickel Silver Gold Alloys Steel Brass Bronze Babbitt Pewter Metal Properties Weight Hardness Malleability Ductility Tenacity Fusibility Conductivity Metal Values Uses of the metals and their common alloys	Introductory talk by the teacher. Display of samples of common metals and alloys for study Assign readings Have pupils classify these metals as to use, value, strength, weight, etc Devise methods of testing pupils on the points of knowledge and ability to recognize, describe and classify the common metals and alloys Give the test for unit I	"Essentials of Metal Working." Berg & Wing, pp. 69, 75, 66-68 "Elementary Wrought Iron." Bollinger, pp. 1-3 "Materials of Industry." Mersereau, pp. 305-428

Specific Objectives	Subject Matter	Suggestive Teaching Procedure	References for Teacher
KNOWLEDGE of The use of precious metals in ancient times The early discovery and use of iron and bronze APPRECIATION of How advancing knowledge of metals and their alloys promotes material progress. Of the enduring value of the precious metals HABITS The reference habit should be developed. The habit of seeking for information until found is an invaluable asset ABILITY To trace briefly the progress in the use of metals from the earliest times to the present	First known uses of the precious metals, gold and silver Assyrians Egyptians Hebrews Early uses of iron and bronze Tools Weapons Ornaments Metal work in ancient times Metal work of the middle ages Metal and our present industrial progress Metals replacing other materials today in Building materials Transportation. Furniture Improved methods in handling and working metals Electroplating New alloys and the future of the metal industries	This is a large subject, but must be treated briefly in this unit An interesting combination of lectures, study, reports, and class discussion should be planned Some lesson material containing minimum facts can be presented for study Certain students can be given assignments for readings, others special topics for written reports A diagram or outline placed upon the blackboard will help to fit certain facts in the mind The conscientious teacher who plans definitely each unit's work will see that all pupils have been exposed to the essential material for this lesson Give the test for the Unit	The instructor can collect valuable material for this unit from many sources: Ancient history Encyclopedias "World Book" "Book of Knowledge" Various arts and craft books "Materials of Industry" Mercereau, pp. 305, 306, 316

UNIT III. STUDY AND CLASSIFICATION OF BENCH METAL TOOLS AND TOOL PROCESSES

Specific Objectives	Subject Matter	Suggestive Teaching Procedure	References for Teacher
KNOWLEDGE of The names of the tools belonging under each classification The tool processes centering around these tools APPRECIATION of The value of good tools, their proper care and operation That there is always the best tool for a certain job HABITS To build up desirable habits with regard to the use and care of the metal tools Carefulness Thoughtfulness Pride in keeping tools in good condition ABILITY to Classify the bench metal tools and processes and to call said tools and processes by their correct names	The tool-room and its organization a. Location of tools b. Tool keeper c. Checking system d. Individual responsibility Classification of tools and processes 1. Laying out tools measuring marking squaring use of patterns 2. Cutting and shaping processes sawing cold chiseling punching drilling filing grinding threading reaming bending peening 3. Assembling processes holding or clamping assembling riveting welding	Some time should be spent at the beginning of this unit in shop orientation. a. Explain the toolroom system b. Review other shop systems c. Rules and regulations d. Shop precautions concerning Running in the shop Distracting attention Relation to machines Care with hand tools Safety first hints First aid The teacher should devise ways of letting the pupils participate in arranging lists of the tools and the processes centering around these tools. No time should be taken here to demonstrate or deeply study each tool and process The aim should be to see that the pupils recognize the tools, call them by their correct name and know what processes center around them Give the test for the unit	"Essentials of metalworking." Berg and Wing. pp. 11-65 "Elementary Wrought Iron." Bollinger pp. 11-41 "General Metal Work." Grayshon. pp. 17-28

Specific Objectives	Subject Matter	Suggestive Teaching Procedure	References for Teacher
KNOWLEDGE of The kinds of wire How wire is made Base metals for wire Present uses of wire Wire sizes APPRECIATION of Wire as a very useful commodity in modern life The possibilities of wire uses from the wire fence to the harp, or the bale of hay to the aeroplane HABITS The habit of finding full information concerning common things rather than taking them for granted Thrift in saving pieces of wire for use ABILITY To recognize kinds of wire To measure wire with the standard wire gauge To manipulate wire, using it for various purposes	Metals and alloys used in the manufacture of wire Gold Silver Copper Iron Aluminum Steel Brass Methods of making wire Wire coatings Wire gauges Iron wire uses & products Steel wire " " " Copper wire " " " Brass wire " " " Gold wire " " " Silver wire " " " Tools and processes involved in working wire Measuring Cutting Bending Filing Winding Twisting Projects Mending things with wire Making useful articles with wire Hook Scriber	Discuss the wire industry and its products Introduce wire samples A carefully planned program of talks, reports on assignments and demonstrations will be fruitful in bringing to the pupils the interesting facts about wire Have pupils compete with each other in bringing in lists of the different wires with their uses and products Demonstrate how to use copper and iron wire in common mending jobs This is the first unit in the course involving tool activities, so considerable instruction and demonstration will be needed Guide in the selection of a useful project involving iron or steel wire Give test for the Unit	"Encyclopedia Britannica." Topic "Wire" American Steel and Wire Co. Chart of Wire Products Industrial Literature—for wire and wire products Wholesale Catalogues—for wire kinds and sizes "World Book" "Book of Knowledge" Topic "Wire" "Essentials of Metal working for tool processes "101 Metalworking projects" Peterson pp. 3-6, 25

Specific Objectives	Subject Matter	Suggestive Teaching Procedure	References for Teacher
KNOWLEDGE of The origin, preparation, properties, and use of wrought iron and its present substitute (mild steel) Tool processes involved APPRECIATION of The strength, durability and natural beauty of iron The artistic possibilities in its manipulation HABITS of Skill, stamina and patience required in handling refractory metals Willingness to learn Thinking the job through ABILITY to Distinguish between wrought iron and other forms of iron Use eye and hand in the construction of artistic and useful iron products	Pig iron Cast iron Wrought iron Swedish iron Mild steel manufacture properties shapes and sizes uses Tools steel rule scriber square center punch hack saw cold chisel machine hammer files drill vise clamp Processes laying out cutting bending twisting drawing-out peening filing drilling riveting Projects (suggested) Foot scraper, door pull bracket, tea stand	Introduce the new unit of work, discussing its interesting possibilities Conduct a study of wrought iron and mild steel, using various samples The teacher can use his scrap book of iron projects to create interest in the field. Well-made models and samples of artistic iron pieces will motivate the work Seek to develop the artistic taste and a high regard for real craftsmanship Demonstrate the use of the tools in carrying out the needed processes Guide in the selection of projects and require a free hand sketch and list of materials Give the test for the unit	"Elementary Forge Practice." Harcourt p. 13 "Essentials of Metalworking." Berg and Wing. pp. 76-87, 11-65, 112 "Elementary Wrought Iron." Bollinger pp. 1 & 2, 11-41 Encyclopedias, Book of Knowledge and other like reference books. Topic "Iron." Industrial Literature Wholesale catalogs "101 Metalworking Projects." Peterson pp. 20-40 "Materials of Industry." —Mersereau pp. 305-326

UNIT VI. STANDARD PIPE

Specific Objectives	Subject Matter	Suggestive Teaching Procedure	References for Teacher
KNOWLEDGE of Pipe manufacture Pipe kinds Pipe sizes APPRECIATION of The importance of sanitary plumbing in modern life HABITS Home mechanics habits of watching for and attending to unsanitary plumbing conditions about the home ABILITY to Identify the common pipe fittings Cut, thread, ream, and assemble pipe satisfactorily	Standard pipe How made Measurements I. D. Uses Coatings Other kinds of pipe O. D. casing Brass Copper Lead Cast iron Terra cotta Wood Ancient and modern plumbing TOOLS Pipe vise Pipe cutter Pipe dies Pipe taps Reamer Hack saw Pipe wrenches PROCESSES Cutting Threading Reaming Fitting The study of (12) of the most common fittings in (9) pipe sizes	Introduce the unit with a brief discussion of standard pipe and modern plumbing Allow the pupils to ask questions and comment on the subject Samples of the various kinds of pipe should be displayed and discussed as to Kind Sizes Use Durability A comparison of modern plumbing with ancient methods will be interesting Present the common pipe fittings have pupils learn names, how to tell sizes, and how they are used Demonstrate the cutting, threading, reaming and assembling of standard pipe Have all pupils participate in these processes by making a 6″ nipple out of ½″ or ¾″ pipe Give the test for the unit	Encyclopedias and other similar reference books Topic "Pipe" "The House Owner's Book" Churchill pp. 247-268 "Mechanics of the Household" Keene pp. 82-124 Industrial literature Wholesale Catalogs for pipe fittings and pipe tools

UNIT VII. COPPER, ITS USES A ND MANIPULATION

Specific Objectives	Subject Matter	Suggestive Teaching Procedure	References for Teacher
KNOWLEDGE of Copper, its mining, smelting, properties, commercial forms, uses, and manipulation APPRECIATION of The practical and artistic uses for copper Its adaptability for manipulation Its beauty and durability HABITS Desire to know all about the material with which one is working Always looking for the beautiful in form and design ABILITY to Identify copper and be able to use the metal working tools fashioning it into some beautiful and useful article	Copper Mining Smelting Properties Value Measure Commercial forms Sheets—cold rolled, hot Rolled Bars Tubing Pipe Wire Rivets, etc. Uses Electrical work Gutter pipe on buildings Utensils Tool Processes Laying out Cutting Bending Raising Planishing Annealing Piercing Filing Finishing Projects Paper knife Corners for box	The resourceful teacher will devise tactful methods of imparting the desired information. The interest factor must always be present. Pupil participation in the discussions and reports are most profitable Lists can be made of the commercial forms and uses of copper Display copper samples Discuss the characteristics of copper Mention the present over-production and its bearing upon the price Discuss the malleability of copper and its relation to certain tool processes Assign the projects Demonstrate the steps of procedure Closely supervise individual work Give the test for the unit	"Essentials of Metalworking. "Berg and Wing pp. 70-71 Encyclopedias and other similar reference material Topic "Copper" Industrial Literature Wholesale catalogs "101 Metalworking Projects" Peterson pp. 6-10, 26, 27 Arts and Crafts books "Materials of Industry" Mersereau pp. 392-411

Specific Objectives	Subject Matter	Suggestive Teaching Procedure	References for Teacher
KNOWLEDGE of Brass, its production properties, commercial forms, uses, and manipulation APPRECIATION of The beauty, utility, and durability of this alloy Its antiquity The sacred metal of the orient HABITS of Observation Investigation Economy ABILITY To recognibe brass and use the hand tools to work it into beautiful and useful articles	Brass Its manufacture Properties Value Measure Commercial forms Sheets—cold rolled and Half hard Bars Tubing Pipe Wire Screws, etc. Uses Hardware Water pipe Machinery Utensils Arts and crafts Tool processes Laying out Cutting Bending Piercing Riveting Filing Finishing Projects Candle Holder Name plate Hinge straps and catch For a box	The possibilities for enrichment in this unit are many The teaching procedure can follow closely that of the preceding unit Explain the difference between brass and bronze and call attention to their antiquity Present samples of brass and discuss the commercial forms Have pupils make lists of commercial uses and products of brass Discuss the value of solid brass as compared to brass coated articles Guide in the selection of projects Demonstrate again the use of certain hand tools As pupils work with the different metals they should be led to experience the metal properties and characteristics through manipulation as well as through study Give test for the unit	"Essentials of Metalworking" Berg and Wing p. 74 Encyclopedias and other similar reference books Topic "Brass' Industrial Literature Wholesale catalogs "101 Metalworking Projects" Peterson pp. 14-19 Arts and Crafts books "Materials of Industry" Mersereau p. 426

UNIT IX. STEEL, ITS USES AND MANIPULATION

Specific Objectives	Subject Matter	Suggestive Teaching Procedure	References for Teacher
KNOWLEDGE of The chief kinds of steel, their manufacture, properties, and uses New steel alloys APPRECIATION of The fact that steel has made possible our machine age The fact that even steel can be abused and requires intelligent care HABITS Intelligent care of steel tools and other steel products Accuracy and good judgment in working with steel ABILITY To test and identify the common kinds of steel To use the hand metalworking tools to work with steel with some degree of success	Steel Cold rolled Machine Tool steel Low carbon Medium carbon High carbon Alloy steels Methods of manufacture Chief characteristics Commercial forms Forgings Castings Bars Shapes Sheets Present uses Hand tools and processes (Reviewed) Projects Pocket wrench Calipers Dividers Pocket square	The information and experiments of this unit are fundamental to the understanding and appreciation of our present industrial life and prerequisite to future study in the metal field The talks, reports and discussions should be well planned and systematically carried out Samples of the various kinds of steel in their commercial forms should be studied The hand tools should be discussed again with special reference to their use with different steels Projects should be chosen within the ability of the pupils and close individual supervision given during the manipulative work Give the test for the unit	"Essentials of Metalworking" Berg & Wing pp. 86-99, 11-65 "Elementary Forge Practice" Harcourt pp. 14, 15 "Elementary Wrought Iron" Bollinger pp. 1-3, 11-42 "General Metal Work" Grayshon pp. 17-28 Encyclopedias and other similar reference books Industrial literature Wholesale catalogs "101 Metalworking Projects" Peterson pp. 53-54 "Materials of Industry" Mersereau pp. 328-385

Specific Objectives	Subject Matter	Suggestive Teaching Procedure	References for Teacher
KNOWLEDGE of The common forms of heat treating metals APPRECIATION of The practical possibilities resulting from various forms of heat treating The beautiful effects that heat can produce HABITS Thoughtfulness Attentiveness Speed—Necessary factors in applying heat to metals ABILITY to Anneal metals Case-harden and temper small tools made in the shop	Heat treatments of metals Smelting Refining Alloying Shaping Welding Annealing Hardening Heat effects on metals Oxidizing Scaling Burning Coloring Melting Foundry Practice Casting Metals High carbon iron Low carbon iron Brass Bronze Aluminum. Babbit Method of annealing, tempering, and case-hardening Projects Application of the desired heat treatments to the metal projects made in this course	This unit is introducing another very broad subject that can only be dealt with in a very elementary way Such processes as smelting, refining, and alloying can be explained clearly and in an interesting manner by the teacher who has made the industrial contacts Most of the other processes listed under "Subject Matter," can be put over by demonstration and experimentation in the shop Foundry practice should be discussed. If possible, take the boys for a trip to a foundry and other plants where any form of heat treatments of metals is carried on Closely supervise the work of the pupils in hardening their projects Give the test for the Unit	"Essentials of Metalworking." Berg & Wing, pp. 102-111, 127-136 "Elementary Forge Practice." Harcourt, pp. 101-117 "101 Metalworking Projects." Peterson, pp. 53-64

Sheet Metal Work Beginners' Course

SHEET METAL WORK—BEGINNERS' COURSE

Twenty weeks of five one-hour periods—Eighth Grade—Required.

UNIT I. INDUSTRIAL BACKGROUND AND STUDY OF MATERIALS

Specific Objectives	Subject Matter	Suggestive Teaching Procedure	References for Teacher
KNOWLEDGE of: The common metal sheets and their sources Relationship of trade names of materials with their protective coatings and most common uses APPRECIATION of The magnitude and increasing importance of the metal industries The many occupations related to the sheet metal industry HABITS of: Independent thinking Logical thinking Reading for content Working independently. Cooperation where it is warranted ABILITY To recognize, properly name and describe at least 8 of the common metal plates	Ore to base plate Common black sheet Locker steel sheet Furniture steel sheet Auto body steel sheet Galvanized steel sheet Galvaneal steel sheet Coke tin plate Charcoal tin plate Roofing (Terne) plate Aluminum Zinc Copper Lead Tin Brass Solder	Introductory information and instruction Stress the value of a thorough understanding of the language of the occupation as related to tools, materials and the processes Compare the increasing production and use of metal with the decline in supply and use of wood Have samples of the common metal and alloy sheets available for study and comparison. Organize and define the new vocabulary Each assignment should be aimed at a measurable result The pupil should be aware, at all times, of just what is expected of him and how his work will be measured Results should be measured and recorded at frequent intervals The True-False, and Multiple response types of tests are quite satisfactory	"Essentials of Metalworking." Berg & Wing, pp. 76-102 "Sheet Metal Work." Trew & Bird, pp. 1-10 "Sheet Metal Workers Manual." Broemel, pp. 11-21 "Elements of Sheet Metal Work." Welch, pp. 11-13 Metal Workers local supply catalogs "Materials of Industry." Mersereau, pp. 305-428

UNIT II. SIMPLE LAYOUT AND ESTIMATING, PRINCIPLES AND PRACTICE

Specific Objectives	Subject Matter	Suggestive Teaching Procedure	Teacher References
KNOWLEDGE of The principles of parallel line, radial line and correct methods of laying out patterns on paper and on metal Methods of estimating quantities and costs Trade terms for kind and thickness Stock sizes of materials APPRECIATION of The meaning and application of the triangulation process. Difficulties that arise from lack of knowledge of trade terms and names of tools and materials HABITS of Economy in the use of time and materials Accuracy and neatness. Correctly caring for tools and supplies ABILITY to Lay out to scale and full size, in radial and parallel line with minimum waste. Work to accuracy limits of $\frac{1}{32}$" Estimate quantities and costs. Speak the language of the subject and follow printed instructions	Drawing equipment. Representative metal layout work Hand shear instruction and practice Student assignments, texts, and reference materials Vocabulary New words, new application of old words, terms or expressions Pronunciation Definitions Spelling Review material data as necessary	Decide upon certain standard materials, sizes, and kinds, to be used for major portion of future practice work Lay a strong foundation of understanding of the trade names and terms applied to these materials. Use scale drawings to assist in working out problems of estimating quantities and costs of these materials Maintain standard practices in scale drawings Standard practices for metal layout work may be developed with full size paper drawings, representative of the kind of metal, division of standard sheet, and the thickness intended. Stress metal surface layout methods for conservation of materials and time The principles of hand shear operation may be put in practice through cutting all full-size drawings The minimum essentials of one assignment should be mastered before the pupil is allowed to proceed to the next The fast-moving pupil may be given more problems or be allowed to go on to the next unit. All tests should be practical and in written form	"Sheet Metal Pattern Drafting and Shop Problems." Daugherty, pp. 25-64-87 "Sheet Metal Workers Manual." Broemel, p. 222. "Estimating Sheet Metal Work." Berg & Wing. Supply Catalogs (Teaching Procedure) (Cont.) Keep accurate records of pupil accomplishment and rate of progress The recall type of test lends itself to strengthening the vocabulary and spelling

Specific Objectives	Subject Matter	Suggestive Teaching Procedure	Teacher References
KNOWLEDGE of Correct principles of metal layout, and hand shear operation The intended purpose of each material and layout Safety requirements APPRECIATION of The results of accuracy and the necessity for close attention to the work The value of independent thought and action The ability to read with understanding HABITS of Thought organization. Thinking with accuracy. Orderliness Ability to Give correct specifications for each tool or material used Use and care for the tools and materials required Recognize and describe the materials used	The metal stock as previously decided Layout tools Cutting tools Assignments References Texts Additions to vocabulary Pronunciation Definition and spelling of the new words Standard stock lists Protective coatings of the metals used Costs of materials used Safety factors in handling tools and materials	Explanation of method and desired accomplishment Responsibility for requesting required tools and materials should rest with the student Correct specification is important. Before cutting is permitted, all marking or layouts should be inspected for accuracy and economy Emphasize the troubles caused by false lines The pupil is greatly assisted in his cutting if his understanding of hand shear operation is accurately and carefully checked in the early stages of the work. The first operations should be watched closely for the common faults and the pupil be made aware of the causes and effects Particular attention should be given to cutting errors that lead to waste of material or hazard to the person. Pupil should figure the cost of each piece of material used. Price per pound or unit of area from the unit package cost Organized presentation of new words, terms, or expressions should result in an increased pupil vocabulary as the prime objective. The type of assignment should promote pupil spelling ability Pupil should be tested frequently (objectively where possible) on measuring, marking, cutting, kinds of material, quantities, costs, vocabulary and spelling Keep accurate and complete record of pupil progress	"Essentials of Metalworking." pp. 12-19 "Instruction Man. for S. M. Workers." Selvidge & Christy, pp. 29, 32, 152, 153 "S. M. W. Manual" Broemel, pp. 129-136, 156-161, 531-532 Supply catalog. Local

UNIT IV. PROCESSES OF CONSTRUCTION AND ASSEMBLY—STUDY AND PRACTICE

Specific Objectives	Subject Matter	Suggestive Teaching Procedure	Teacher Reference
KNOWLEDGE of Name and purpose of each tool or machine to be used. Tool and machine capacities, metal thickness, etc Cause and effect of the difficulties encountered in tool operations Hazards to person Hazards to equipment Assembly processes APPRECIATION of The value of an organized plan of work The results of action without thought Good reading ability HABITS of Improved observation Thinking Expression Attitude ABILITY to Pass recognition tests on seams, joints, and processes State all requests for tools, materials or information in the proper terms	Materials previously cut Tools and equipment assembly Common assembly processes and tool operations involved Lap seams Flat lock seams Grooved lock seams. Riveted seams Snap, or can seam Double seams Box corners Forming Reinforcement and Embellishment Single hem Double hem Wired edges False wiring Beading Crimping Raising Flanging Stretching	Statement of purpose and procedure. Explain methods of assignment, testing, and marking. The percentage system is recommended for all except quarterly and semester marks Each practice assembly should stop at the point where soldering is required. This will insure a quantity of material for soldering practice in the next unit. This is quite necessary Careful organization of instructional material for tool operation and assembly practice is highly important. Best available references are in the order named The pupil should make a study of the various seams, joints, and processes. This should result in a good understanding of the uses, construction and appearance of each The Recall type of test is recommended to strengthen the vocabulary and understanding of the language of the subject. It is likewise conducive to better habits of spelling if given with that factor in mind The True-False test seems well-adapted for measuring progress at close intervals Adequate record facilities are imperative if the best interests of the pupil are served	"Instruction Manual for Sheet Metal Workers" Selvidge & Christy "Sheet Metal Workers Manual" Broemel. "Elements of Sheet Metal Work." Welch

Specific Objectives	Subject Matter	Suggestive Teaching Procedure	References for Teacher
KNOWLEDGE of: Purpose of the flux Purpose and care of the soldering copper Causes for given reactions. The meaning of the new words, terms, etc. APPRECIATION of The exacting nature of the job. The results that accrue from careful thought and action. The importance of following operative instructions to the letter HABITS of Concentration, neatness, and accuracy Continuous effort Reasoning from cause to effect ABILITY to: Accurately and quickly decide if the soldering copper is fit for use Quickly and efficiently recondition a copper to best suit the job at hand	Soldering coppers Purpose, preparation, use. Fluxes Cleaning dips Salammoniac Borax Muriatic acid Chloride of zinc. Cut acid Rosin and mixtures for applying Patent varieties Pastes Salts Solder Common bar Triangular bar Common wire Acid core wire Rosin core wire Material previously processed Additions to vocabulary	Give pupil an outline of the unit, its purpose and importance Methods of assigning work, testing and marking Thoroughly explain— Purpose of the copper Preparation and reasons for tinning the new copper and the old copper When and why forging is necessary The methods of heating, forging, filing, and tinning copper The pupil should acquire knowledge and judgment in regard to the proper temperatures for filing, forging, and tinning required in the soldering of different metals under varied conditions. This increased facility should result from observation, study, and experience; the sense of feel, length of time that the copper is in the fire, and a knowledge of the practical heating quality of the heat unit Pupil training should include—the why and how of the various fluxes. (Standardize on an adequate variety and instruct fully in regard to purpose, application and result desired.) Instructions in the proper application	"Sheet Metal Workers Manual." Broemel. "Inst. Manual for Sheet Metal Workers" Selvidge and Christy "Elements of Sheet Metal Work." Welch

Specific Objectives	Subject Matter	Suggestive Teaching Procedure	References
KNOWLEDGE of Safety factors APPRECIATION of The home uses for soldering ability The waste of time and material resulting from inattention to details HABITS ABILITY to Judge right heat for good work Recognize the demands of the "job—strength—appearance —type" Use the copper with assurance, neatness, and economy Handle the copper without hazard to person or equipment. Select right flux Speak in occupational terms		of the copper to the given job—types of soldering jobs—methods of conveying solder to the desired point—soldering in easy positions—in difficult positions. Pupil should be entirely familiar with the vocabulary of the unit. Marking for practical accomplishment may be best done at certain pre-arranged working levels. Previously mentioned tests may be used for interval and final measurement of knowledge and judgment.	

UNIT VI. APPLIED PRACTICE IN LAYOUT AND CONSTRUCTION

Specific Objectives	Subject Matter	Suggestive Teaching Procedure	References for Teacher
KNOWLEDGE of: Standard layout principles. Common manipulative processes The common materials. Special fields within the occupation Specifications terms for tools, materials, and processes APPRECIATION of: Good workmanship Material values Responsibility to school, society, and self The ability to think and work with logical independence as a prerequisite to successful cooperative effort HABITS of: Conscious organization of thought, action, and speech. Reasonable self-confidence Up-grading of self in reading abilities ABILITY to: Meet new situations with confidence Complete difficult assignments with a degree of success Understand and speak the occupational language Safeguard self and fellow workers Cooperate	Individual construction experiments Group experiments Surface development Parallel line Simple to semi-complex Radial line Simple to semi-complex Triangulation Simple problems Equipment All regular school shop equipment Materials Any that may be generally used in sheet metal and related work. Occupational language Condensed material in review of previous work	Brief outline of purpose and procedure Pupil should be made entirely aware of all new words, terms, and expressions Review material, covering the work of preceding units, should be available for individual use as needed Pupil individuality and varying ability should be developed through a wide variety of individual experiments. A very limited number of simple home repair jobs might be included Organize a few simple group experiments *Special bents within the occupation should be encouraged *Special fields within the industry should be discovered by the pupil A sharp lookout should be kept for evidence of special abilities Definitely timed interval tests for measuring pupil progress, in knowledge and judgment Grade manipulative work Complete the pupil's record	"Sheet Metal Workers Manual." Broemel "General Metal Work" Grayshon "Inst. Manual for S. M. Workers" Selvidge & Cristy "Elements of Sheet Metal Work." Welch Trew and Bird in "Sheet Metal Work" for some typical experiments. Not for processes

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